



Charting Climb Gradients

ACF – April 2015

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Southwest Airlines



Topics

■ Charting

- Simplify the information for Charting of Climb Gradients

■ Criteria

- Return to approval by AFS for any climb gradient greater than 500' NM
- Altitude restrictions should be considered climb gradients.
- Use of block altitudes



Order 8260.46E

■ Paragraph 2-1-1 (D)2

- Flight Standards Service must approve DP's requiring a climb gradient in excess of 500 ft/nm.

■ Paragraph 2-1-1 (E)2

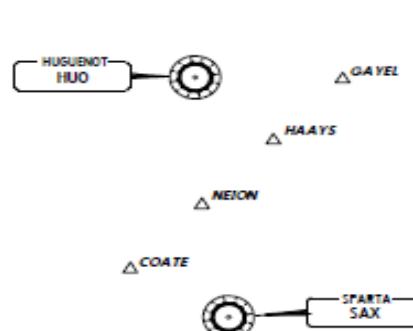
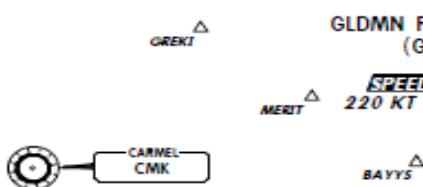
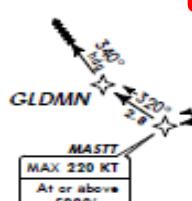
- Do not establish CGs for crossing altitudes used to support airspace, environmental, or ATC operational limitations.



Climb Gradients

**KLGA/LGA
LA GUARDIA**

JEPPESSEN NEW YORK, NY
26 APR 13 10-3 Eff 1 May RNAV SID

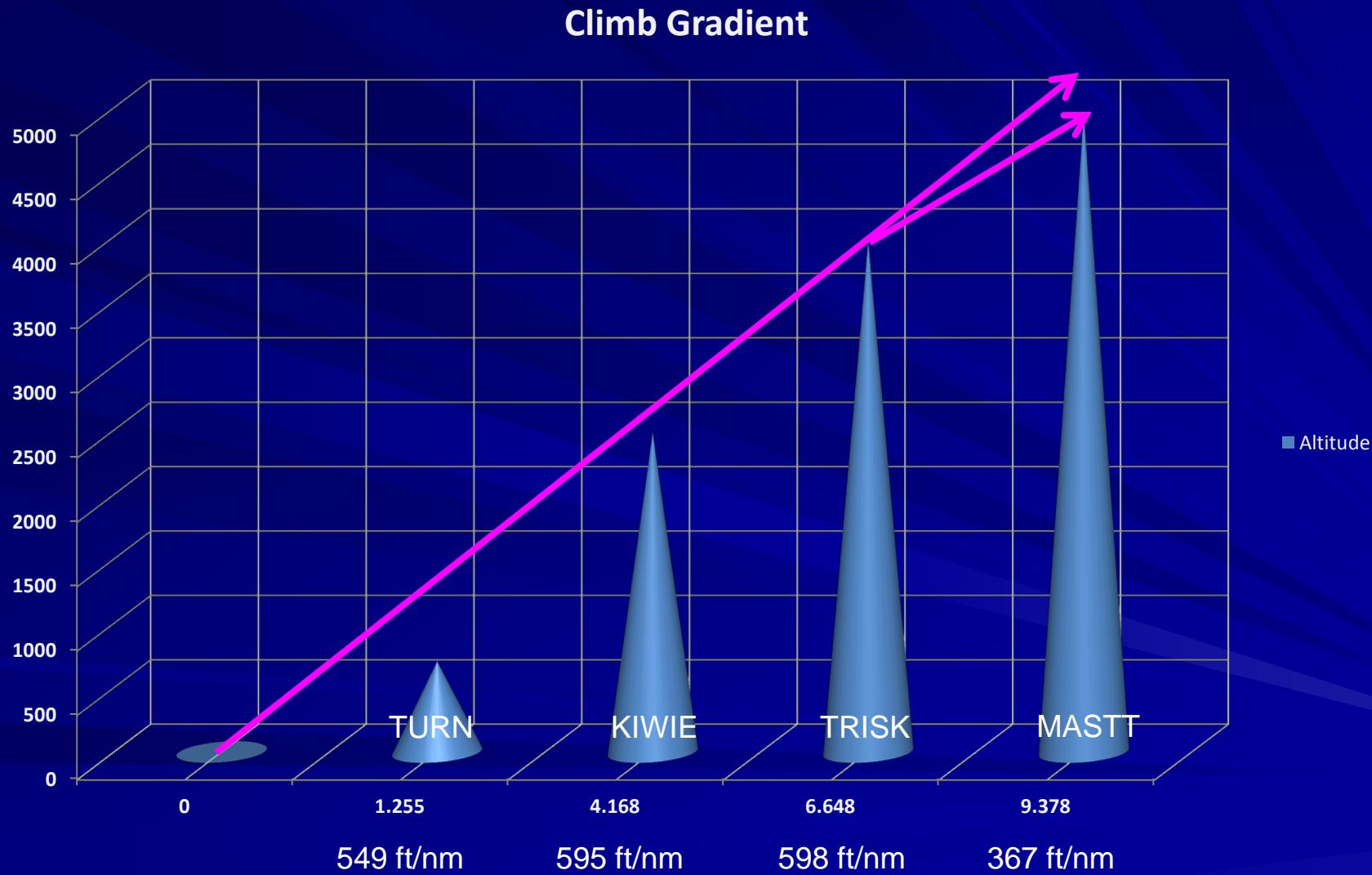
NEW YORK Departure (R) 120.4	Apt Elev 21'	Trans level: FL180 Trans alt: 18000'. 1. DME/DME/IRU or GPS required. 2. RNAV 1. 3. RADAR required for non-GPS equipped aircraft. 4. For turbojets only. 5. Traffic filed BIGGY, ELIOT, LANNA, NEWEL, PARKE, ZIMMZ do not exceed 250 KT until reaching 11000'. 	6. Strict compliance to track and altitude restrictions is mandatory. Aircraft performance may require reduced airspeed to comply with altitude restrictions. Advise ATC on initial contact if unable to comply with climb gradient requirements. 7. All aircraft EXCEPT vectors after GLDMN.																																				
			GLDMN FOUR RNAV DEPARTURE (GLDMN4.GLDMN) (RWY 13) SPEED: DO NOT EXCEED 220 KT UNTIL PASSING MASTT																																				
																																							
			NOT TO SCALE																																				
			GLDMN MAX 220 KT At or above 5000'																																				
		OBSTACLES Hwy 13: Located on centerline. 1 Stack, fences, 1 beginning 97' from DER, 171' LEFT of centerline, up to 83' AOL/103' MSL. Fences, buildings, and trees beginning 28' from DER, 415' RIGHT of centerline, up to 21' AOL/22' MSL. Stack 4934' from DER, 1513' LEFT of centerline, 172' AOL/181' MSL. Building 1.9 NM from DER, 758' RIGHT of centerline, 280' AOL/345' MSL.	This SID requires take-off minimums (for standard minimums, refer to airport chart): Rwys 4, 22, 31: Not authorized - ATC. Rwy 13: Standard (or lower than standard, if authorized) with minimum climb of 563' per NM to 710', then ATC climb of 615' per NM to 2500', then ATC climb of 605' per NM to 4000', then ATC climb of 367' per NM to 5000'.																																				
		<table border="1"> <thead> <tr> <th>Gnd speed-KT</th> <th>75</th> <th>100</th> <th>150</th> <th>200</th> <th>250</th> <th>300</th> </tr> </thead> <tbody> <tr> <td>367' per NM</td> <td>459</td> <td>612</td> <td>918</td> <td>1223</td> <td>1529</td> <td>1835</td> </tr> <tr> <td>563' per NM</td> <td>704</td> <td>938</td> <td>1408</td> <td>1877</td> <td>2346</td> <td>2815</td> </tr> <tr> <td>605' per NM</td> <td>756</td> <td>1008</td> <td>1513</td> <td>2017</td> <td>2521</td> <td>3025</td> </tr> <tr> <td>615' per NM</td> <td>769</td> <td>1025</td> <td>1538</td> <td>2050</td> <td>2563</td> <td>3075</td> </tr> </tbody> </table>	Gnd speed-KT	75	100	150	200	250	300	367' per NM	459	612	918	1223	1529	1835	563' per NM	704	938	1408	1877	2346	2815	605' per NM	756	1008	1513	2017	2521	3025	615' per NM	769	1025	1538	2050	2563	3075	INITIAL CLIMB Climb heading 134° to intercept course 185° to cross KIWIE at or above 2500', then on 234° track to cross TRICK at or above 4000', then on 272° track to cross MASTT at or above 5000', then on track 320° to GLDMN, then on heading 340° for vectors on course.	ALTITUDE Maintain 5000' or as assigned by ATC
Gnd speed-KT	75	100	150	200	250	300																																	
367' per NM	459	612	918	1223	1529	1835																																	
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			ROUTING EXCEPT clearance to filed altitude/flight level 10 minutes after departure.																																				

CHANGES: None.

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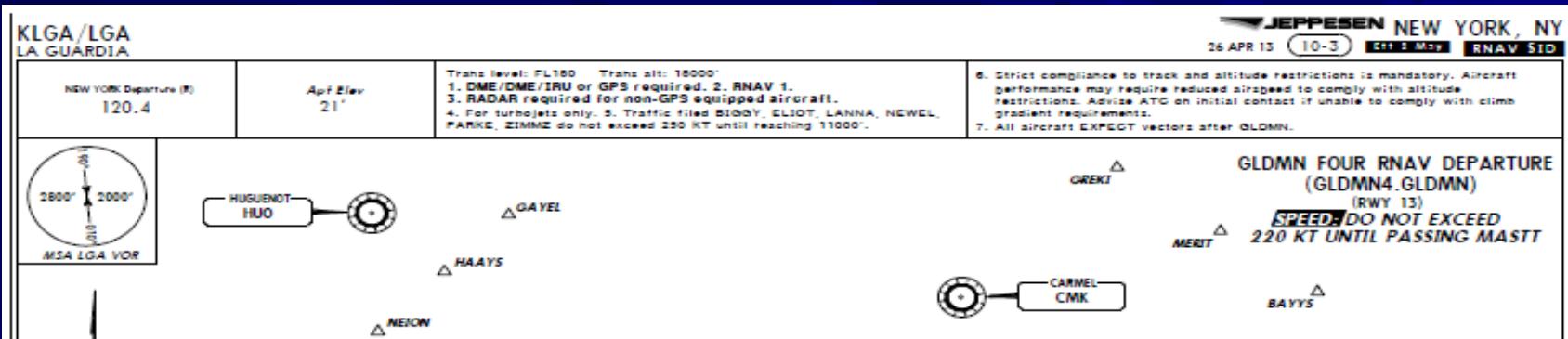


GLDMN Climb Gradients



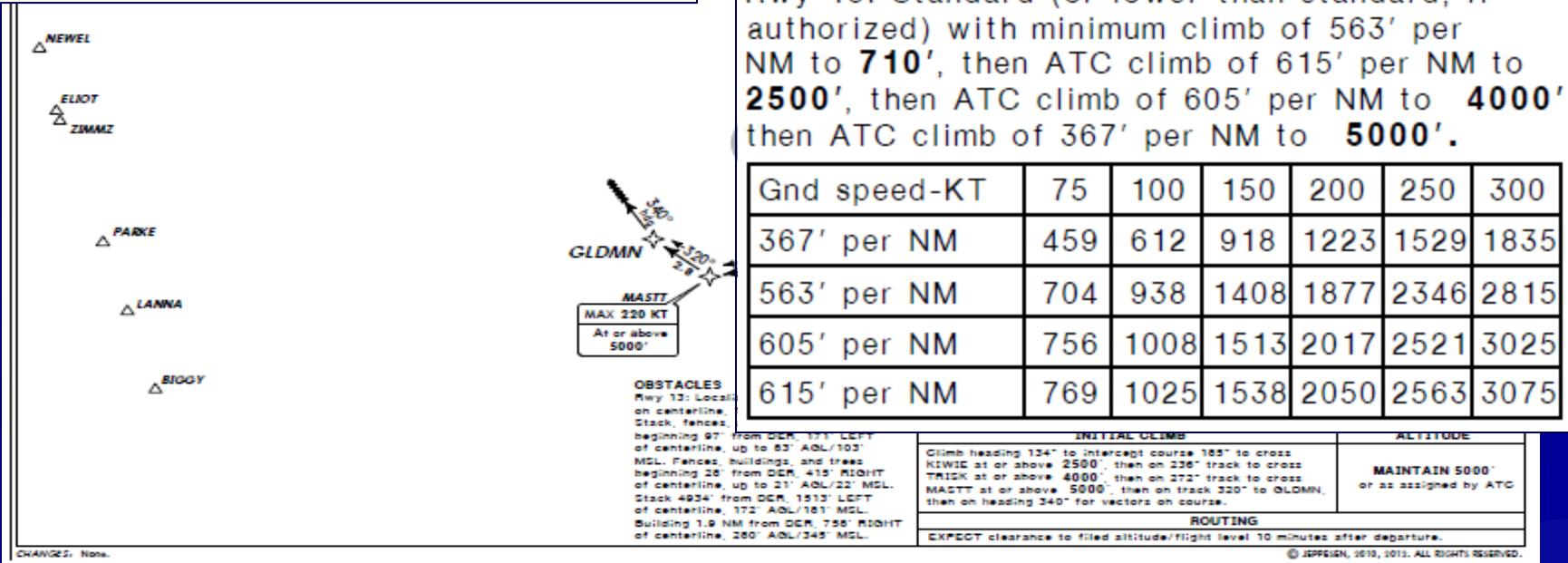


Climb Gradients



Rwy 13:

Minimum ATC climb gradient of 598' NM to 4000', then ATC climb of 367' per NM to 5000'.





Climb Gradients

KDAL/DAL DALLAS LOVE

Regional Departure (R) 118.55	Apt Elev 487'	Trans Level: FL180 Trans alt: 18000' 1. RADAR required. 2. RNAV 1. 3. DMC/DMC/IRU or GPS required.	4. For use by turbojet aircraft only. 5. Prog file and EXPECT WYLIE or HUBBARD Departure. 6. For aircraft requesting FL180 or above. 7. Turbojets requesting 17000' and below EXPECT GARLAND Departure. 8. SODAY Transition ATC assigned only.
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JEPPESEN DALLAS, TEXAS
12 SEP 14 (10-3M) 01116 SEA RNAV SID

LNDRE ONE RNAV DEPARTURE (LNDRE1.LNDRE)

DRSET
N32 45.6 W096 45.1

HAYZZ
N32 42.7 W096 41.8

SHRAM
N32 41.0 W096 39.7

LNDRE
N32 40.8 W096 32.2

At or above 4000'
At or above 6000'
At or above 7000'

OBSTACLES
EXPECTED filed altitude 10 minutes after departure.

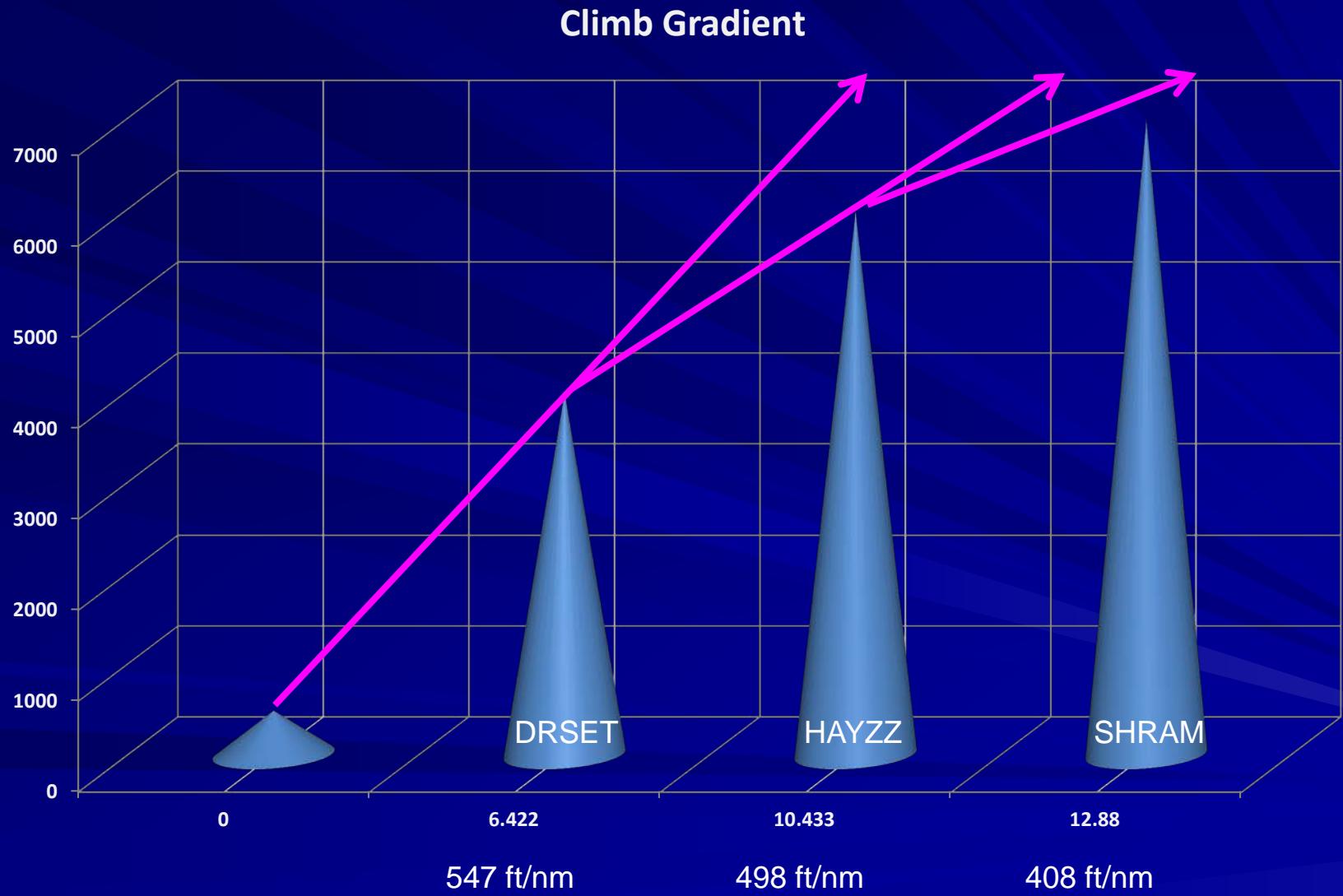
CHANGED: New procedure in this airport.

This SID requires take-off minimums (for standard minimums, refer to airport chart):
 Rwys 13L/R: Standard (or lower than standard, if authorized) with minimum climb of 500' per NM to 1200'.
 Rwys 31L/R: Standard (or lower than standard, if authorized) with minimum climb of 500' per NM to 1000'.

Gnd speed-KT	75	100	150	200	250	300
500' per NM	625	833	1250	1667	2083	2500



LNDRE Climb Gradients





Climb Gradients

Climb from runway 13R to:

Waypoint	Miles	Gradient
DRSET	6.422	547 ft/nm
HAYZZ	10.433	528 ft/nm
SHRAM	12.88	506 ft/nm

Climb waypoint to waypoint: (TAS 285 KTAS)

13R to DRSET = 547 ft/nm

DRSET to HAYZZ = 498 ft/nm

HAYZZ to SHRAM = 408 ft/nm



Climb Gradients

All Engine Climb Gradient (FT/NM)

Altitude FT	Normal Climb Profile			Flaps Up Maneuver Speed to 10K	V2+20 to 3K AGL, then Flp Up Man Spd to 10K
	CLB 2	CLB 1	CLB	CLB	CLB
2000	690	760	840	840	1110
2500	550	630	710	710	1060
3000	500	570	650	650	1030
3500	490	570	650	650	1000
4000	470	550	630	660	910
4500	440	520	600	670	820
5000	420	490	570	670	770
5500	410	490	570	680	730
6000	420	490	570	680	730
6500	420	490	570	680	720
7000	420	490	580	680	720

Average
Climb
Gradient

FT/NM

Close



Climb Gradients

KDAL/DAL
DALLAS LOVE

REGIONAL Department (R)
118.55

Agt Elec
487"

Trans level: FL100 Trans alt: 45000
1. RADAR required. 2. RNAV 1.
3. DMC/DME/IRU or GPS required.

JEPPESEN DALLAS, TEXAS
12 SEP 14 10-3M EFT 18 SEC RNAV SID

12 SEP 14 10-3M EPH 18 SEC RNAV SID

500

RNAV SID

Using FL100 or above. T. Turboprop requesting 17000' and below EXCEPT GARLAND Departure. ATC assigned only.

LNDRE ONE RNAV DEPARTURE (LNDRE1..LNDRE)

Climb Gradient

CLB-2	420 ft/nm
CLB-1	490 ft/nm
CLB	580 ft/nm

A small icon consisting of a vertical line with a horizontal base, representing a scale or ruler.

Rwy 13L and 13R:

Minimum ATC climb gradient of 547' NM to 4000' per NM. Then ATC climb of 498' NM to 6000'. Then ATC climb of 408' NM to 7000'.

This SID requires take-off minimums
(for standard minimums, refer to airport chart):
Rwys 13L/R: Standard (or lower than standard,
if authorized) with minimum climb of 500' per
NM to 1200'.

Rwys 31L/R: Standard (or lower than standard, if authorized) with minimum climb of 500' per NM to 1000'.

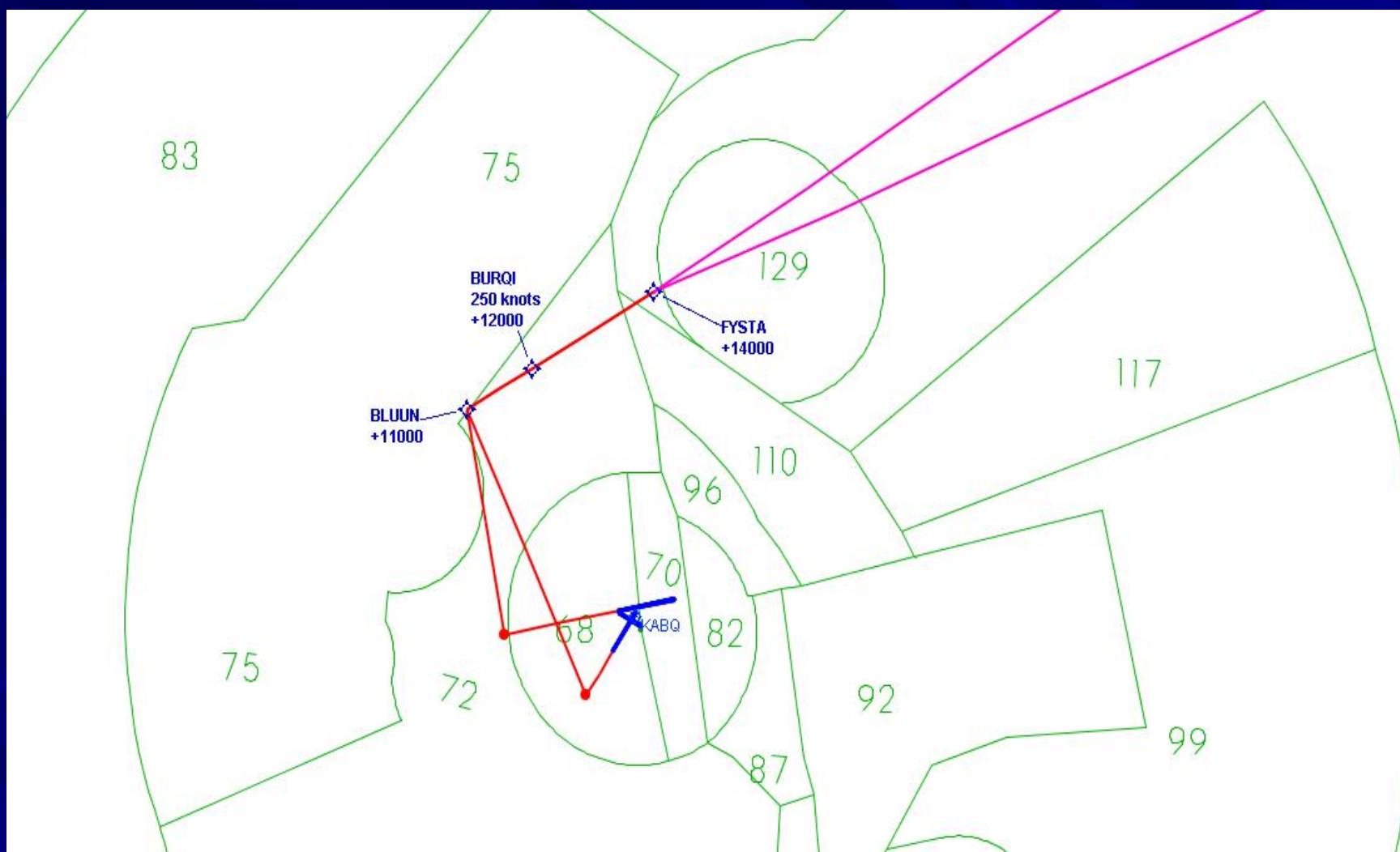
OBSTACLES FOR TAKEOFF OBSTACLE NOTES see 10-3051.	
RWY	INITIAL CLIMB
13L/R	Climb heading 130° to 1000', then direct to cross DMST at or above 4000', then on track 130° to cross HATZ at or above 6000', then on track 120° to cross SHRAM at or above 7000'.
31L/R	Climb Heading 310° to 1000', then heading 310° or as assigned by ATC, except RADAR vectors to cross SHRAM at or above 7000'. ROUTING

This SID requires tailwind (for standard minimums) or a 30L/R Standard (if authorized) with a NIM to 1200'. Rwyas 31L/R Standard (if authorized) with a NIM to 1000'.

Gnd speed-KT	75	100	150	200	250	300
500' per NM	625	833	1250	1667	2083	2500



ABQ DP Altitudes





ABQ Climb Gradients

CHANGES: Procedure renumbered, revised.

This SID requires take-off minimums (for standard minimums, refer to airport chart):
 Rwy 21: Standard (or lower than standard, if authorized) with minimum climb of 500' per NM to 12900'.
 Rwy 26: Standard (or lower than standard, if authorized) with minimum climb of 500' per NM to 13100'.

Gnd speed-KT	75	100	150	200	250	300
500' per NM	625	833	1250	1667	2083	2500

OBSTACLES

Rwy 21: Terrain beginning 159' from DER, 77' RIGHT of centerline, up to 5315' MSL. Terrain beginning 199' from DER, 100' LEFT of centerline, up to 5311' MSL.

KABQ/AB
ALBUQUERQUE
Departure (R)
127.4

ALBUQUERQUE
ALBUQUERQUE

This SID requires take-off minimums (for standard minimums, refer to airport chart):

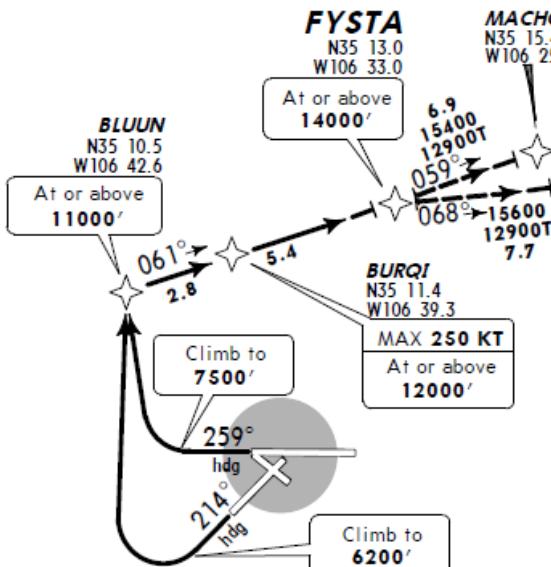
Rwy 21: Standard (or lower than standard, if authorized) with minimum climb of 500' per NM to 12900'.

Rwy 26: Standard (or lower than standard, if authorized) with minimum climb of 500' per NM to 13100'.

Gnd speed-KT	75	100	150	200	250	300
500' per NM	625	833	1250	1667	2083	2500

Direct distance from Albuquerque Int'l Sunport to:
 BLUUN 9 NM

1. aircraft. C on initial contact.	FYSTA) ING BURQI
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RWY	INITIAL CLIMB
21	Climb heading 214° to 6200', then RIGHT turn direct BLUUN, cross BLUUN at or above 11000', then on track 061° to BURQI, cross BURQI at or above 12000', then on track 061° to FYSTA, cross FYSTA at or above 14000'.
26	Climb heading 259° to 7500', then RIGHT turn direct BLUUN, cross BLUUN at or above 11000', then on track 061° to BURQI, cross BURQI at or above 12000', then on track 061° to FYSTA, cross FYSTA at or above 14000'.

ROUTING

From FYSTA, on transition. MAINTAIN FL200, EXPECT filed altitude 10 minutes after departure.



ABQ Climb Gradients

CHANGES: Procedure renumbered, revised.

This SID requires take-off minimums (for standard minimums, refer to airport chart):
 Rwy 21: Standard (or lower than standard, if authorized) with minimum climb of 500' per NM to 12900'.
 Rwy 26: Standard (or lower than standard, if authorized) with minimum climb of 500' per NM to 13100'.

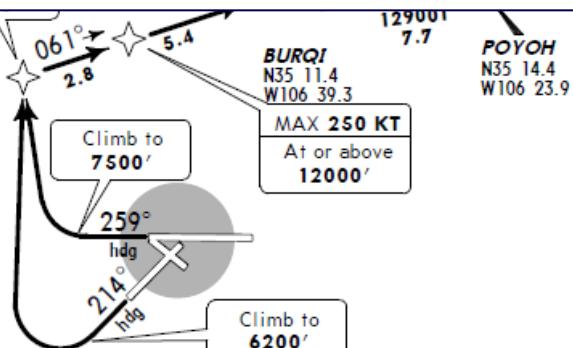
Gnd speed-KT	75	100	150	200	250	300
500' per NM	625	833	1250	1667	2083	2500

OBSTACLES

Rwy 21: Terrain beginning 159' from DER, 77' RIGHT of centerline, up to 5315' MSL. Terrain beginning 199' from DER, 100' LEFT of centerline, up to 5311' MSL.
 Rwy 26: Sign 38' from DER, 431' LEFT of centerline, 14' AGL/5314' MSL.

EVSTA **MACHO**

Rwy 21 and Rwy 26:
Minimum Terrain climb gradient of 500' NM to 12,000', then Terrain climb gradient of 372' per NM to 14,000'

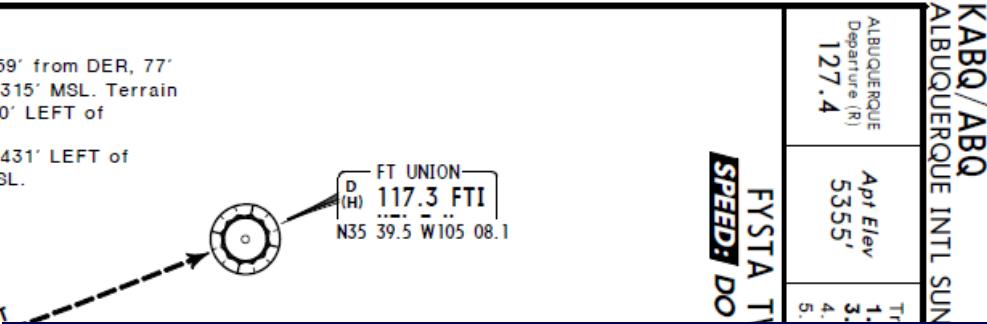


INITIAL CLIMB

RWY	INITIAL CLIMB
21	Climb heading 214° to 6200', then RIGHT turn direct BLUUN, cross BLUUN at or above 11000', then on track 061° to BURQI, cross BURQI at or above 12000', then on track 061° to FYSTA, cross FYSTA at or above 14000'.
26	Climb heading 259° to 7500', then RIGHT turn direct BLUUN, cross BLUUN at or above 11000', then on track 061° to BURQI, cross BURQI at or above 12000', then on track 061° to FYSTA, cross FYSTA at or above 14000'.

ROUTING

From FYSTA, on transition. MAINTAIN FL200, EXPECT filed altitude 10 minutes after departure.



This SID requires take-off minimums (for standard minimums, refer to airport chart):
 Rwy 21: Standard (or lower than standard, if authorized) with minimum climb of 500' per NM to 12900'.
 Rwy 26: Standard (or lower than standard, if authorized) with minimum climb of 500' per NM to 13100'.

Gnd speed-KT	75	100	150	200	250	300
500' per NM	625	833	1250	1667	2083	2500

(RQI)	at contact.
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QUE, N MEX
RNAV SID



Recommendations

- Any climb gradient greater than 500 ft/nm requires AFS approval.
- Use a linear slope calculation not a point to point calculation.
- Simplify the text to assist with performance analysis.
- Specify both ATC and Obstacle requirements.
- Allow altitude restriction compliance with MVA-MIA requirements versus TERPS requirements.
- Use the least number of climb gradients.
- Remove block altitudes from SID criteria.